Factors That Affect Student Attitude Toward Biology

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Abstract: The assumption that students will acquire positive attitudes toward science as they learn more science is no longer valid. This study confirmed the reliability of the Biology Attitude Scale developed by Russell and Hollander (1975). We also concluded that whether a student is a biology major or non-major in itself is not a determining factor when measuring the effect an introductory course has in changing attitude toward biology. We found a slight negative correlation between expected grade and attitude change and also a slight negative correlation between actual grade and attitude change.

Key Words: students' attitudes; Likert scales; Cronbach Alpha Reliability Coefficients; Majors; Non-majors

Introduction

Attitudes toward biology and learning in general are areas of interest to educators past and current. The term attitude (toward science) should be used to refer to a general and enduring positive or negative feeling about science (Koballa and Crawley 1985). Instructors who are new to the study of attitudes toward learning may want to read "Developing Attitude Toward Learning" (Mager 1984). This book is an excellent source about reasons individuals may feel a certain way toward a subject and how to measure and improve these attitudes.

A number of articles have been published that have expressed different ideas about attitudes towards biology/science. All agree that it is important that college students leave our classes with as favorable an attitude toward biology as possible. The generalization that biology majors have a favorable attitude toward science is usually assumed, but not well substantiated.

Studies report that the general public (non-majors) do not necessarily have positive feelings toward science and scientists. Some students have negative stereotypes of science and scientist; they view us as "nerds" or "mad scientists" (Gardner, et al. 1989). Others describe us as hard, old, frightening, and colorless (Brush 1979). These beliefs may lead to a negative attitude toward science.

Specifically, one study reports that many students do not have a positive attitude toward biology when they enter their first college-level biology class. In this study conducted at the University of Oklahoma, three-hundred seventy students were asked to indicate on a five-point scale how important they felt biology was to their lives. The scale ranged from "extremely important" to "not important at all." Fifty percent rated biology in the bottom three categories. The students were also asked to rank ten disciplines in order of importance to the average American citizen. Biology finished fifth out of ten. Uno (1988), who conducted these surveys, concluded that the students feel biology is not critical to their lives.

Previous science courses may affect attitudes that college students hold toward biology. In addition, the entertainment industry's portrayal of scientists may have an effect on our students' attitudes toward science. The media sometimes presents scientific achievements as foreboding, and the media is possibly to blame for the negative attitudes of students toward science (Sadava 1976).

It would be very unfair to place all the blame on the media or primary and secondary education systems. Frequently articles and television programs show biology in a very positive light. Certainly there are many outstanding teachers in our schools who do an excellent job in teaching biology and other sciences, which should have a positive influence on their students. Unfortunately their efforts and accomplishments are not always recognized or rewarded.

It is important that students leave our classes with a positive attitude toward biology. A phrase used frequently in discussions about higher education is "lifelong learning." It would be difficult to argue against the merits of lifelong learning, but is it realistic to expect one to independently learn more about a subject if the individual has a negative attitude toward the subject?

Russell and Hollander (1975) quoted from Mager (1968) "The likelihood of the student putting his knowledge to use is influenced by his attitude for or against the subject. Things disliked have a way of being forgotten... One objective toward which to strive is that of having the student leave your influence with as favorable an attitude toward your subject as possible. In this way he will remember what has been taught, and will willingly learn more about what has been taught."

The attitudes with which our students leave our classes may have an effect on us later. Hayes (1980) wrote "Our students (non-majors) are potential lawyers and managers. As citizens, they will influence..."
how research and development funds are spent.” A positive attitude and appreciation of biology may have an influence on these decisions.

Many thoughts exist on why attitudes toward biology or science in general may be negative. Students’ attitudes are influenced by a host of factors: their past experiences, sense of competence, need to acquire knowledge, motivation, goals, home backgrounds, school and classroom environments, biases of peer groups, and students’ perceptions of rewards associated with learning. Science anxiety, the fear of science learning and apprehension towards scientists and science related activities, is an attitude shaped by these factors (Gottfried, et al. 1993).

A Michigan study examined the effect that a single science course had upon attitudes toward science and scientists that are held by science-shy ninth grade students. A significant difference in attitudes toward science and scientists was found between pre- and post-measurements. However, this study found there was no significant relationship between attitudes toward science and scientists on pre-/post-measurements and their sex, socio-economic background classification, intelligence quotient, grade point average, or their attitude toward the course. No significant difference in attitudes toward science and scientists was found between three separate teacher-student groups in the pre- and post-measurements (Starring 1972).

Studies have shown a positive correlation between attitude and achievement (Russell and Hollander 1975; Schibeci and Riley 1986). Uno (1988) wrote that a negative or indifferent attitude toward science is one reason that non-science majors have difficulty in their college introductory biology classes. There is some support for the proposition that attitudes influence achievement, rather than the reverse (Schibeci and Riley 1986). Attitude is a key ingredient in how students confront educational challenges. The grades students receive also affect their feelings about their ability to understand scientific content and their attitudes toward science. High grades increase students’ self-esteem and promote academic progress. (Gottfried, et al. 1993).

Methods

Our study had several purposes. One was to examine if biology courses designed for a specific audience (biology majors vs. non-majors) made a difference in terms of attitude change. The instrument used in this study was developed by Russell and Hollander (1975). This instrument was designed to detect and measure changes in attitude toward biology, but not intended to measure absolute attitude. This scale is divided into two portions, the first being a 14 item Likert-type scale, the second part consisting of 8 items using a semantic differential scale. However, only the Likert items were used for our purposes.

Russell and Hollander (1975) had previously reported the reliability of the Likert portion of their scale to be 0.90. In this study the Cronbach Alpha Reliability Coefficient was determined to be 0.95.

In this study, the attitude scale was administered to separate introductory biology classes at two universities (see Table 1). All responses were kept anonymous except for a code to identify to which group a student belonged. The survey was administered at the beginning of the semester (pre) and again at the end of the semester (post).

<table>
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<tr>
<th>Table 1. Description of Groups</th>
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<td>Class 1</td>
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<td>Class 3</td>
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<td>Class 4</td>
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Results

It was determined that there was a positive change in attitude for both classes of non-majors; however, a class for biology majors at University A showed a positive change in attitude. The results for University B showed a negative response (see Table 2). All changes were determined to be significant at the 0.05 fiducial level.

<table>
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<th>Table 2. Summary of results of biology attitude scale.</th>
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<td>Pre</td>
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<td>Class 1</td>
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<td>Class 3</td>
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<td>Class 4</td>
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We infer from the data presented in Table 2 that whether students are majors or non-majors is not, by itself, a determining factor in influencing students’ attitudes toward biology.

This study was continued at still another university. The subject group was a large, introductory biology class for non-majors. This group showed an increase in score of 1.4 between the pre- and post-scales. This time other factors were examined in an attempt to ascertain if they had an effect on attitude change. These factors included: class (freshman, sophomore, etc.), age of the students, the number of previous biology courses taken by the student, expected course grade, and actual course grade.

There was a negative correlation of -0.24 between expected grade and attitude gain (p<0.01). There was also a negative correlation of -0.28 between actual grade and attitude gain (p<0.01). There was a positive correlation of + 0.66 between expected grade and actual grade (p<0.01). Class, age, and number of previous biology courses did not show a significant correlation.

Conclusion

This study confirmed the reliability of the Biology Attitude Scale developed by Russell and Hollander (1975). We also concluded that whether a student is a biology major or non-major in itself is not a determining factor when measuring the effect an introductory course has in changing attitude toward biology. We found a slight negative correlation between expected grade and attitude change and also a slight negative correlation between actual grade and attitude change.

Factors which affect attitudes toward biology is an area that deserves more study. Our data from these short term studies should help clarify beliefs or assumptions instructors may have about student attitudes. The issue of attitude toward a subject is complex; perhaps long term studies may generate more insights.

The assumption that students will acquire positive attitudes toward science as they learn more science is no longer valid. Planning is required to increase the probability of developing positive attitudes toward science (Koballa and Crawley 1985). Educators today need to keep aware of the changes we see in our population of students. In particular we need to be aware of our students’ attitudes toward our subject matter and of the effect we have on our students’ attitudes, whether positive or negative. Certainly not all of the factors involved with attitude formation and change are known, nor may they ever be. Nonetheless, instructors can measure the effect their courses have on attitudes, and make adjustments accordingly.

Literature Cited


